



Natural Gas Hot Water Induced Draft BOILERS

INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler.

MODELS

XE-2

XE-3

XE-4

XE-5

This boiler cannot be used with all types of chimneys. Read these instructions carefully before installing.

These Gas-Fired Hot Water Boilers are low pressure, sectional cast iron boilers Design Certified by AGA for use with Natural and Liquefied Petroleum Gases. They are constructed and hydrostatically tested for a maximum working pressure of 50 psi in accordance with A.S.M.E. Standards for cast iron boilers.



WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier. Natural gas boilers are not to be converted to LP Gas.

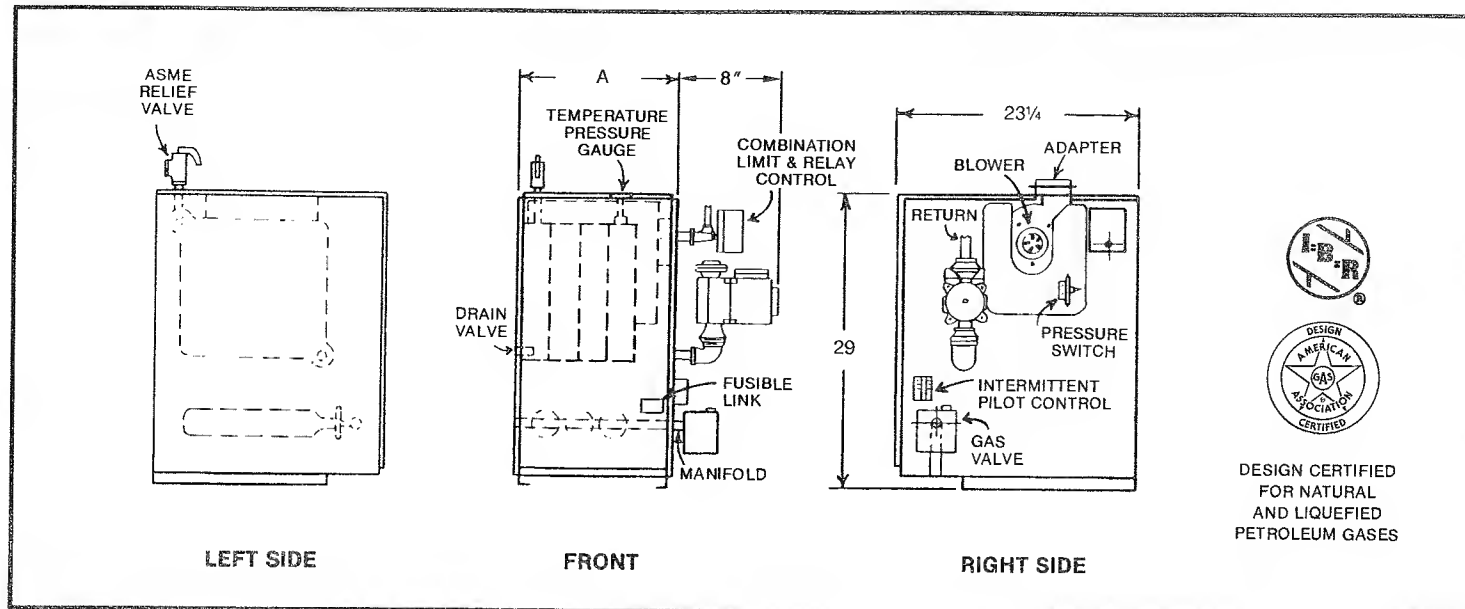


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Boiler Ratings and Capacities

FIG. 1



NATURAL AND LIQUEFIED PETROLEUM GASES

Model	No. Sec.	AGA Input *MBH	Heating Capacity +MBH	Net IBR Rating *MBH	Width A	Flue Diameter INCHES
XE-2	2	42.5	36	31	10 ³ / ₄	4
XE-3	3	75.0	63	55	14	4
XE-4	4	112.5	93	81	17 ¹ / ₄	4
XE-5	5	150.0	124	108	20 ¹ / ₂	4

For elevations above 2,000 ft. ratings should be reduced at the rate of 4% for each 1,000 ft. above sea level

* MBH = 1,000 Btuh

Btuh = British Thermal Unit Per Hour

+ Heating Capacity based on D.O.E. (Department of Energy) test procedure

The Ratings marked "Net I=B=R Ratings" indicate the amount of radiation each boiler will take care of under normal conditions and thermostatic control. The Net I=B=R Ratings shown are based on an allowance of 1.15 in accordance with the factors shown on the I=B=R Standard as published by The Hydronics Institute.

Selection of boiler size should be based upon "Net I=B=R Rating" being equal to or greater than the calculated heat loss of the building.

The manufacturer should be consulted before selecting a boiler for installations having unusual piping and pickup requirements.

These boilers must stand on a non-combustible floor. If installed on a combustible floor, use Combustible Floor Base Number 42135-1.

These Gas Fired Hot Water Boilers are low pressure, sectional cast iron boilers Design Certified by A.G.A. (American Gas Association) for use with Natural and Liquefied Petroleum Gases. They are constructed and hydrostatically tested for a maximum working pressure of 50 psi (pounds per square inch) in accordance with A.S.M.E. (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section IV Standards for cast iron heating boilers.

Before You Start

Check to be sure you have the right size boiler before starting the installation. See rating and capacity table on previous page. Also be sure the new boiler is for the type of gas you are using. Check the rating plate on the right side of the boiler.

You must see that the boiler is supplied with the correct type of gas, fresh air for combustion, and a suitable electrical supply. Also, the boiler must be connected to a suitable chimney or horizontal venting system, and an adequate piping system. Finally, a thermostat, properly located, is needed for control of the heating system. If you have any doubts as to the various requirements, check with local authorities and obtain professional help where needed. Take the time to complete all of the steps for SAFE and PROPER operation of the heating system.

KEEP BOILER AREA CLEAN AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS

Where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. CSD-1*.

The following steps are all necessary for proper installation and safe operation of your boiler.

1. LOCATING THE BOILER
2. FRESH AIR FOR COMBUSTION
3. SYSTEM PIPING
4. CHIMNEY & VENT PIPE CONNECTION
5. GAS SUPPLY PIPING
6. ELECTRICAL WIRING
7. CHECKING & ADJUSTING

Locating the Boiler

If your boiler is part of a planned heating system, locate it as nearly as possible where shown on your plan. If boiler is to be part of an existing system, it is usually best to put it where the old one was. If you plan to change location, you will need additional materials as well as an adequate base. The following rules apply:

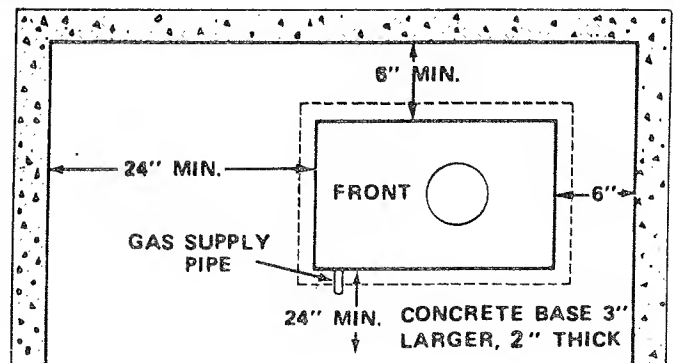
1. The boiler must be level.
2. Use a raised base if floor can become wet or damp.
3. The vent pipe connection should be as short as possible.
4. Maintain clearances for fire safety as well as servicing. See Fig. 2 for minimum clearances.

18" clearance must be maintained at a side where passage is required for access to another side for cleaning or servicing, inspection or replacement of any parts that normally may require such attention. Boilers must be installed at least 6" from combustible material on all sides. Allow at least 24" front and right side for servicing.

5. FRESH AIR for combustion must be available at the front of the boiler. FRESH AIR for ventilation must be available to the front AND rear of the boiler.
6. The floor supporting the boiler must be non-combustible. If it is combustible, place the boiler on Combustible Base No. 42135-1.

7. The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1-latest issue.

FIG. 2 - MINIMUM CLEARANCE DIMENSIONS



THIS UNIT MUST BE SET ON A CONCRETE OR OTHER NON-COMBUSTIBLE MATERIAL BASE OR FLOOR. IT MUST NOT BE INSTALLED ON CARPETING.

Fresh Air for Combustion

Provision for combustion and ventilation air must be in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-latest issue, or applicable provisions of the local building codes.

WARNING

Be sure to provide enough fresh air for combustion. Enough air insures proper combustion and **assures that no hazard will develop due to the lack of oxygen.**

You must provide for enough fresh air to assure proper combustion. The fire in the boiler uses oxygen. It must have a continuous supply. The air in a house contains only enough oxygen to supply the burner for a short time. Outside air must enter the house to replace that used by the burner. Study following examples 1 and 2 to determine your fresh air requirements.

EXAMPLE 1: Boiler Located in Unconfined Space

If your boiler is in an open area (unpartitioned basement) in a conventional house, the air that leaks through the cracks around doors and windows will usually be adequate to provide air for combustion. The doors should not fit tightly. Do not caulk the cracks around the windows.

An unconfined space is defined as a space whose volume is not less than 50 cubic feet per 1,000 Btu per hour of the total input rating of all appliances installed in that space.

EXAMPLE 2: Boiler Located in Confined Space

- A. **All Air from Inside the Building:** The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure.
- B. **All Air from Outdoors:** The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.
- When directly communicating with the outdoors, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.

NOTE

If you use a fireplace or a kitchen or bathroom exhaust fan, you should install an outside air intake. These devices will rob the boiler and water heater of combustion air.

- When communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.
- When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of one square inch per 2,000 Btu per hour of total input rating of all equipment in the enclosure.
- When ducts are used, they shall be of the same cross sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than three inches.

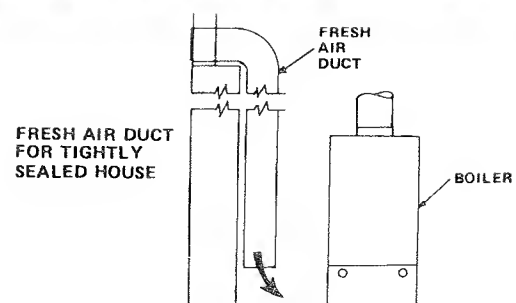
FIG. 3 - FRESH AIR DUCT CAPACITIES

Fresh Air Duct Capacities for Ducts Supplying Fresh Air to boiler in tightly constructed houses. British Thermal Units per hour Input (Btuh)*.

Fresh Air Duct Size	1/4" Mesh Screen Btuh	Wood Louvers Btuh	Metal Louvers Btuh
3" x 12"	144,000	36,000	108,000
8" x 8"	256,000	64,000	192,000
8" x 12"	384,000	96,000	288,000
8 1/2" x 16"	512,000	128,000	384,000

*Based on opening covered by 1/4" mesh screen, wood louvers, or metal louvers.

**FIG. 4
FRESH AIR DUCT FOR TIGHTLY SEALED HOUSE**



Installation System Piping

1. Place boiler in the selected location (as near chimney as possible).
- Your boiler is shipped assembled. You need only to install the Relief Valve and a drain line to carry any water to a drain.
2. Install Relief Valve on $\frac{3}{4}$ " pipe nipple in tapped opening in the left end section. Connect a drain line of the same pipe size ($\frac{3}{4}$ ") to carry any water away to a drain.
3. Install Drain Valve on lower left side of boiler as marked.
4. Connect Supply and Return Lines to boiler. The connections may require certain additional fittings and parts, as shown on diagram (Figs. 5 and 6).

If you are replacing an old boiler with this new one, possibly all you will need do is to connect the existing piping to your boiler, and install the Relief Valve.

If you are installing an entire new heating system, first install all of your radiation units (panels, radiators or cabinets) and the Supply and Return Mains - then make the connections at the boiler.

In connecting the cold water supply to the water valve, make sure that a clean water supply is available. When the water supply is from a well or pump, a sand strainer should be installed at the pump.

When boiler is used in connection with refrigeration systems it shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler (Fig. 7).

When this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation, the piping system shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

A hot water boiler installed above radiation level must be provided with a low water cutoff device either as a part of the boiler or at the time of boiler installation.

When a low water cutoff is used, a periodic inspection and flushing of float types is necessary.

FIG. 5 - FORCED HOT WATER TYPICAL PIPING

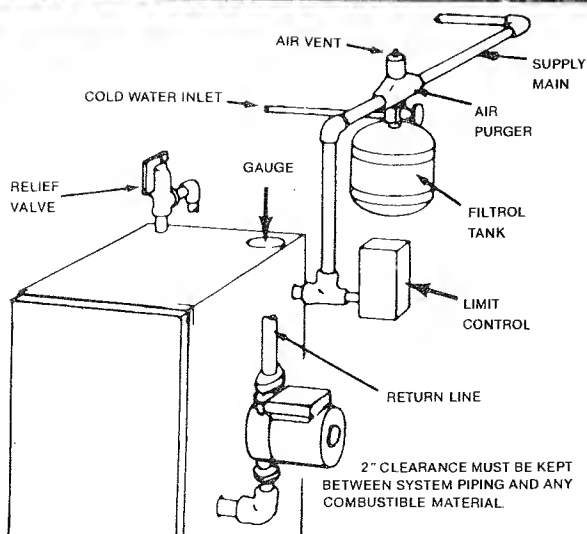


FIG. 6 - FORCED HOT WATER TYPICAL PIPING WITH ZONE CONTROL VALVES

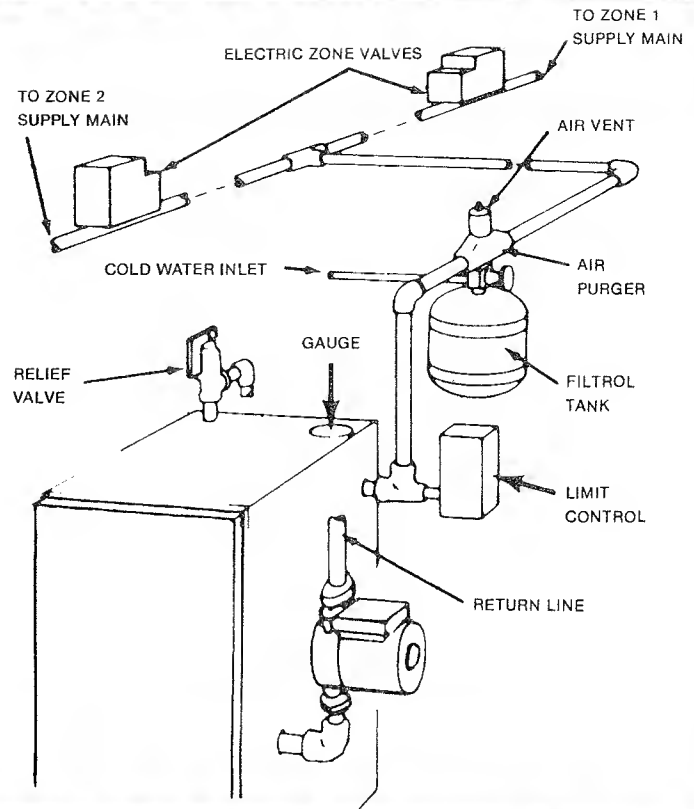
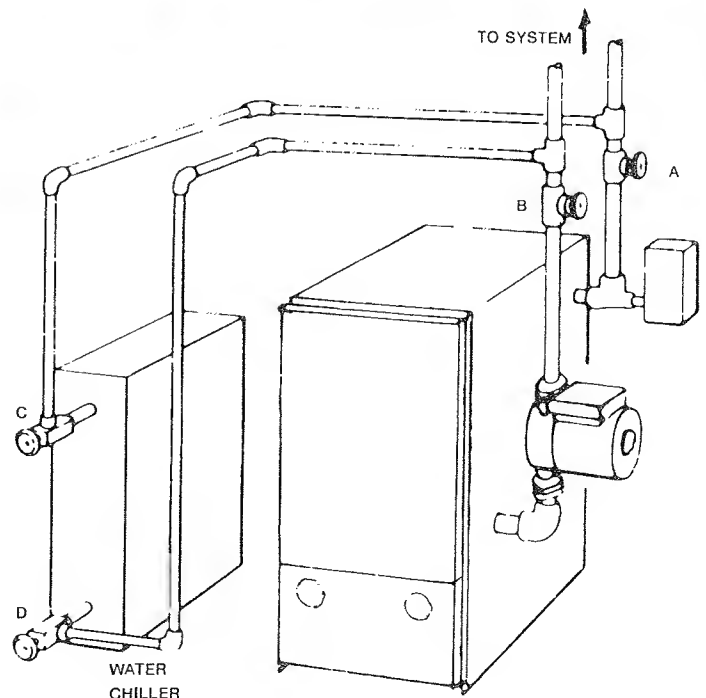


FIG. 7 - PIPING ARRANGEMENTS FOR BOILER WHEN USED IN CONNECTION WITH REFRIGERATION SYSTEM

VALVES A & B - OPEN FOR HEATING; CLOSE FOR COOLING
VALVES C & D - CLOSE FOR HEATING; OPEN FOR COOLING



Chimney and Vent Pipe Connection

For boilers for connection to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1-latest issue and applicable provisions of the local building codes.

CHECK YOUR CHIMNEY

This is a very important part of your heating system. It must be clean, the right size, properly constructed and in GOOD CONDITION. No boiler can function properly with a bad chimney.

1. Use local codes for installation or National Fuel Gas Code Z223.1-latest issue.
2. These are high efficiency boilers with a low stack or exhaust temperature.
3. If venting into a masonry chimney without a tile liner, line the chimney from top to bottom with a minimum 6" dia. flue pipe.
4. Venting to an outside masonry chimney will require a 304 stainless steel pipe run up the entire chimney.
5. When a gas-fired water heater (with no vent damper) is vented into the same chimney, the 304 stainless steel pipe is not required.
6. The vent pipe from the boiler to the chimney should run as directly as possible with as few elbows as possible.
7. Do not connect to fireplace flue.
8. Do not install a damper on this boiler.
9. The chimney can serve both the boiler and water heater if the two connections into the chimney are kept 6 inches apart (see Page 7).
10. Slope pipe up from boiler to chimney not less than 1/4" per foot.
11. End of vent pipe must be flush with the inside face of the chimney flue. Use a sealed-in thimble for the chimney connection.
12. The sections of vent pipe should be fastened with sheet metal screws to make the piping rigid. Use stovepipe wires to support the pipe from above.

MINIMUM VENT PIPE CLEARANCE

If the vent pipe must go through a crawl space, double wall vent pipe should be used. Where vent pipe passes through a combustible wall or partition, use a ventilated metal thimble. The thimble should be 4 inches larger in diameter than the vent pipe.

If boiler is installed with single wall vent, it must have a 6" clearance between its surface and any combustible material. A new Type B gas vent must be installed in accordance with the instructions furnished with the vent. Maintain clearances as specified for the vent pipe.

Check the vent pipe to see if it is firestopped where it goes through the floor or ceiling. It should have an approved vent cap with clearances from the roof as shown in Fig. 8. If clearances are less than shown in Fig. 8, have the vent checked by local authorities.

For boilers for connection to gas vents or chimney vent installations shall be in accordance with Part Venting of Equipment, of the National Fuel Gas Code ANSI Z223.1-latest issue and applicable provisions the local building codes.

Vent connectors serving appliances vented by natural draft shall not be connected into any portion mechanical draft systems operating under positive pressure.

REMOVING EXISTING BOILER FROM COMMON VENTING SYSTEM

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation while the other appliances remaining connected to the common venting system are not in operation.

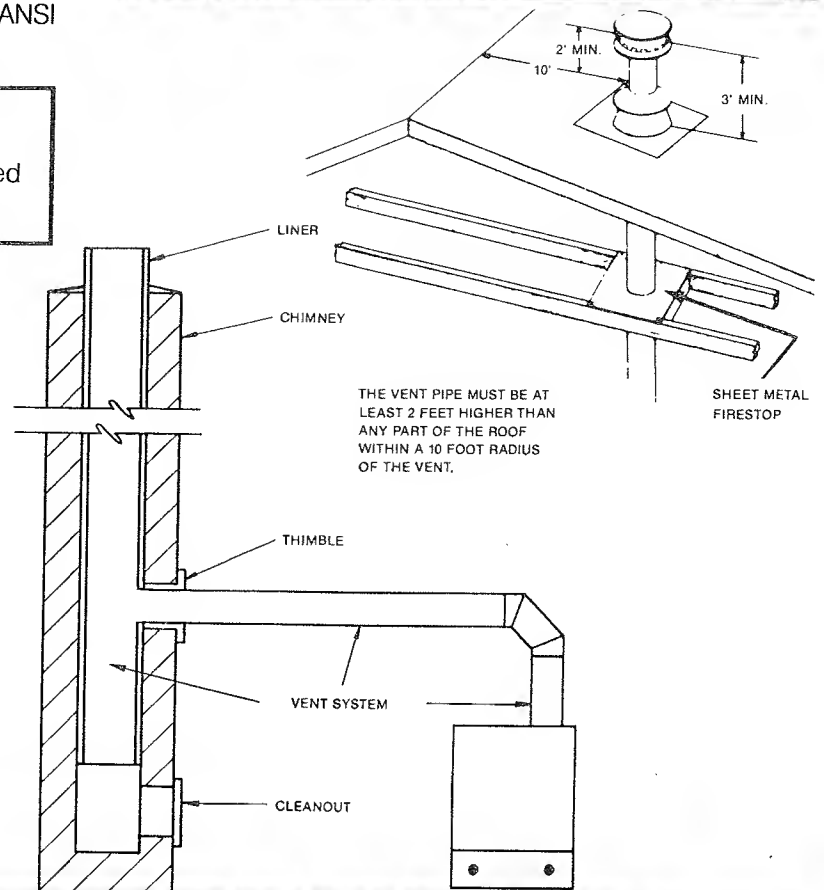
1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size, horizontal pitch and determine there is no blockage, restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliance remaining connected to the common venting system is located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with National Fuel Gas Code, ANSI Z223.1-latest issue. When resizing any portion of the common venting system,

common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix G in the National Fuel Gas Code, ANSI Z223.1-latest issue.

NOTE

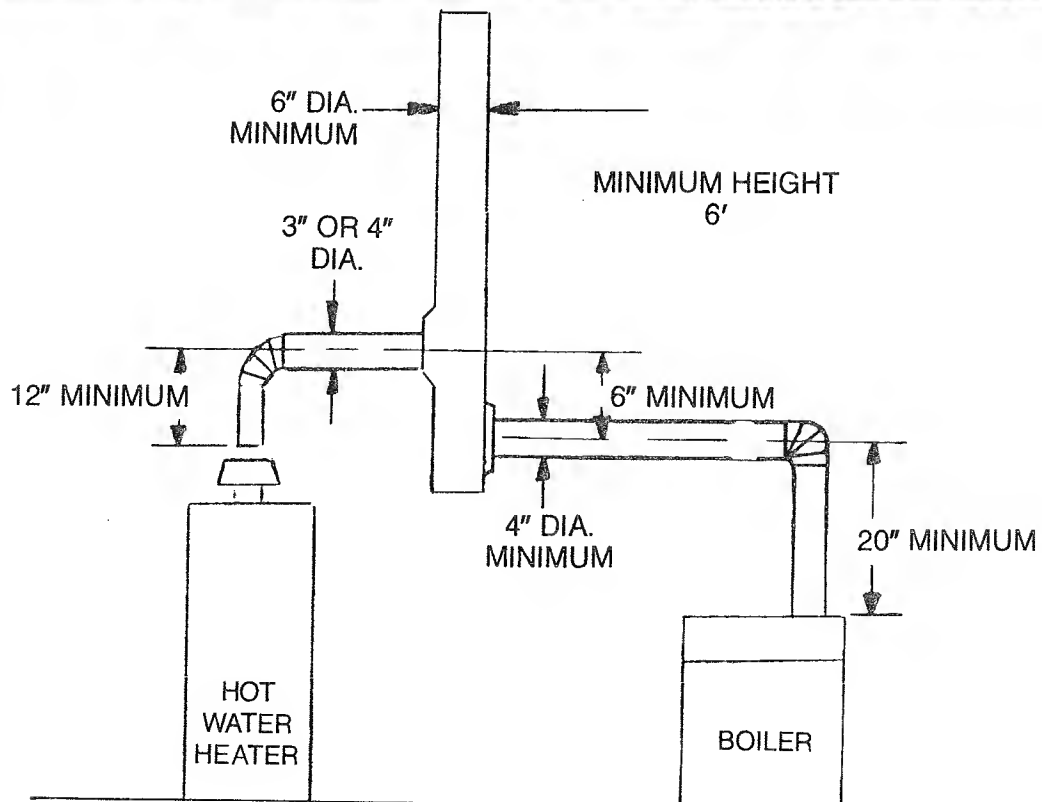
It is recommended that existing gas vents be checked to be sure they meet local codes.

FIG. 8 - TYPE B GAS VENT



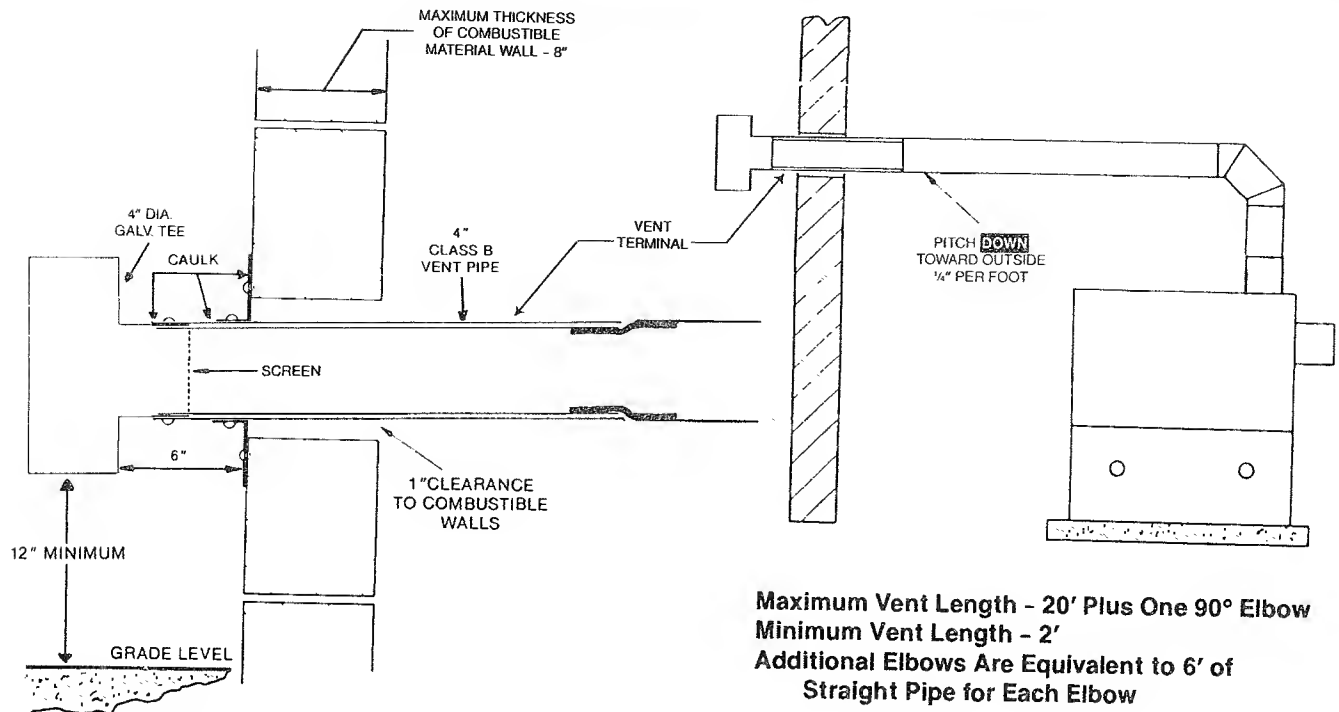
Common Venting with Hot Water Heater

FIG. 9



Horizontal Venting

INDUCED DRAFT HIGH EFFICIENCY BOILERS



Maximum Vent Length - 20' Plus One 90° Elbow
Minimum Vent Length - 2'
Additional Elbows Are Equivalent to 6' of
Straight Pipe for Each Elbow

HORIZONTAL VENTING

Special consideration must be given when locating boilers and horizontal venting system. Boiler and vent system are tested and design certified by A.G.A. for operation in a 40 MPH wind velocity.

To ensure trouble-free operation, locate boiler and vent system away from prevailing winds. Under certain conditions, it may be necessary to install a wind barrier to protect vent termination from high or swirling winds.

1. These boilers may be vented horizontally as shown. The vent pipe is pitched **down** from the boiler to the vent terminal. **Do not** connect other appliances to this vent.
2. Vent Pipe Material:
Standard 4-inch galvanized single wall metal pipe from boiler to vent terminal.
Maintain 6-inch minimum air space clearance to combustibles. Do not run vent through cold areas. Maximum vent pipe length is 20 feet plus one 90° elbow. Minimum length 2 feet. For additional elbows, subtract 6 feet from maximum length for each elbow. Example: With two elbows, maximum vent length would be 14 feet.
3. Vent Terminal:
Standard 4-inch galvanized single wall metal tee on 2 foot length of 4-inch class B vent pipe. Maintain clearances as specified.
 - a) Through combustible walls, maintain 1-inch clearance to combustible materials around class B vent pipe. 8 inch maximum wall thickness.
 - b) Through non-combustible walls, no clearance needed around class B vent pipe.

4. Seal all joints with approved silicone sealant (400° F R silicone rubber or equivalent.)
5. The venting system shall terminate at least 3 feet above any forced air inlet located within 10 feet. The venting system shall terminate at least 4 feet below, 4 feet horizontally from or 1 foot above any door, window, or gravity air inlet in any building. The bottom of the vent terminal shall be located at least 12 inches above grade. Termination of the vent shall be not less than 7 feet above an adjacent public walkway. Termination of the vent should be kept 3 feet away from vegetation. The venting system shall terminate at least 4 feet horizontally from, and in no case above or below, unless a 4 foot horizontal distance is maintained, from electric meters, gas meters, regulators, and relief equipment.
6. Put vent on a wall away from the prevailing winter wind. Locate or guard the vent to prevent accidental contact with people or pets.
7. Terminate the vent above normal snowline. Avoid location where snow may drift and block the vent. Ice or snow may cause the boiler to shut down if the vent becomes obstructed.
8. Under certain conditions, flue gas will condense moisture. In such cases, steps should be taken to prevent building materials at the vent terminal from being damaged by exhaust of flue gas.
9. At the beginning of each heating season check all vent pipes and the tee outside to make sure there are no obstructions.

Gas Supply Piping

CHECK GAS SUPPLY

The gas pipe to your boiler should run direct from the gas meter (or propane regulator). It should supply only the boiler. It must be the correct size for the length of the run and your boiler rating. See Fig. 10 for the proper size. Be sure your gas line complies with local codes and gas company requirements.

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5 kPa).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa).

CONNECTING THE GAS PIPING

Refer to Fig. 11 for the general layout at the boiler. It shows the basic fittings you will need. The gas line enters the boiler from the right side.

The following rules apply:

1. Use black iron piping and fittings.
2. All pipe compound must be resistant to liquified petroleum gas.
3. Install ground joint union in gas supply line between shut-off valve and boiler controls.
4. Install a sediment trap upstream of gas controls.
5. Use two pipe wrenches when making the connection to the gas valve to keep it from turning.
6. Install manual shut-off valve in vertical pipe about 5 feet above floor.
7. Tighten all joints securely.
8. LP - gas connections should only be made by a licensed propane installer.
9. Two-stage regulation should be used by the propane installer.
10. LP - gas piping should be checked out by the propane installer.

CHECKING THE GAS PIPING

Upon completion of piping, check right away for gas leaks. Open the manual shut-off valve. Test for leaks by applying soap suds (or a liquid detergent) to each joint. Bubbles forming indicate a leak. CORRECT EVEN THE SMALLEST LEAK AT ONCE.

WARNING

Never use a match or open flame to test for leaks.

FIG. 10 - GAS PIPE SIZES

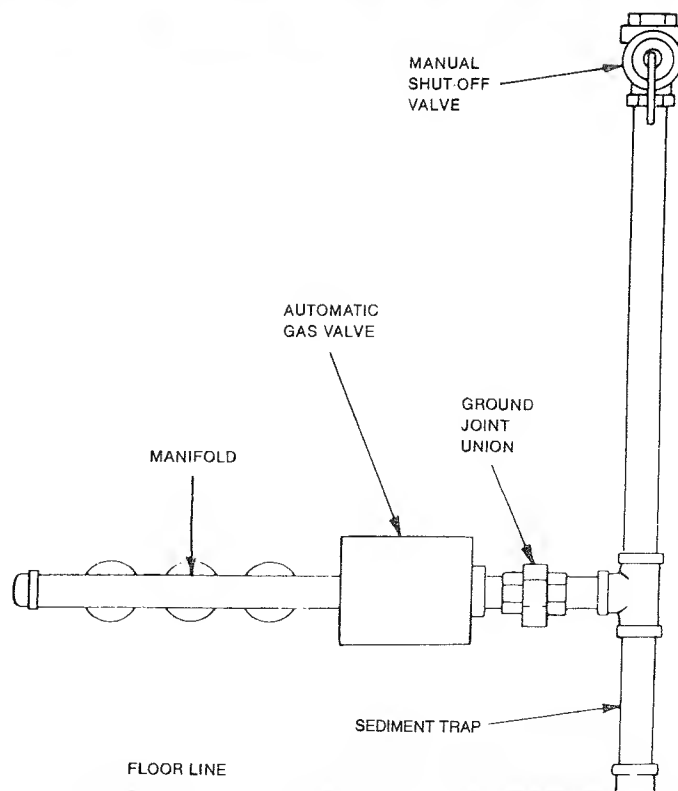
NATURAL GAS				
Length of Pipe - Ft.	Pipe Capacity - BTU Per Hour Input Includes Fittings			
	1/2"	3/4"	1"	1 1/4"
20	92,000	190,000	350,000	625,000
40	63,000	130,000	245,000	445,000
60	50,000	105,000	195,000	365,000

LP - GAS				
Length of Pipe - Ft.	Pipe Capacity - BTU Per Hour Input Includes Fittings			
	Copper Tubing*		Iron Pipe	
	5/8"	3/4"	1/2"	3/4"
20	131,000	216,000	189,000	393,000
40	90,000	145,000	129,000	267,000
60	72,000	121,000	103,000	217,000

*Outside diameter

The length of pipe or tubing should be measured from the gas meter or propane second stage regulator.

FIG. 11 - GAS PIPING AT BOILER



Electrical Wiring

INSTALL YOUR THERMOSTAT

The 24-volt thermostat location has an important effect on the operation of your boiler system. **BE SURE TO FOLLOW THE INSTRUCTIONS INCLUDED WITH YOUR THERMOSTAT.**

GROUNDING

If an external electrical source is utilized, the boiler, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA No. 70-latest issue.

ELECTRIC POWER SUPPLY

WARNING

Turn off electric power at fuse box before making any line voltage connections. Follow local electrical codes.

All electrical work must conform to your local codes as well as the National Electrical Code. If you are not familiar with wiring and codes in general, have a competent electrician do this job.

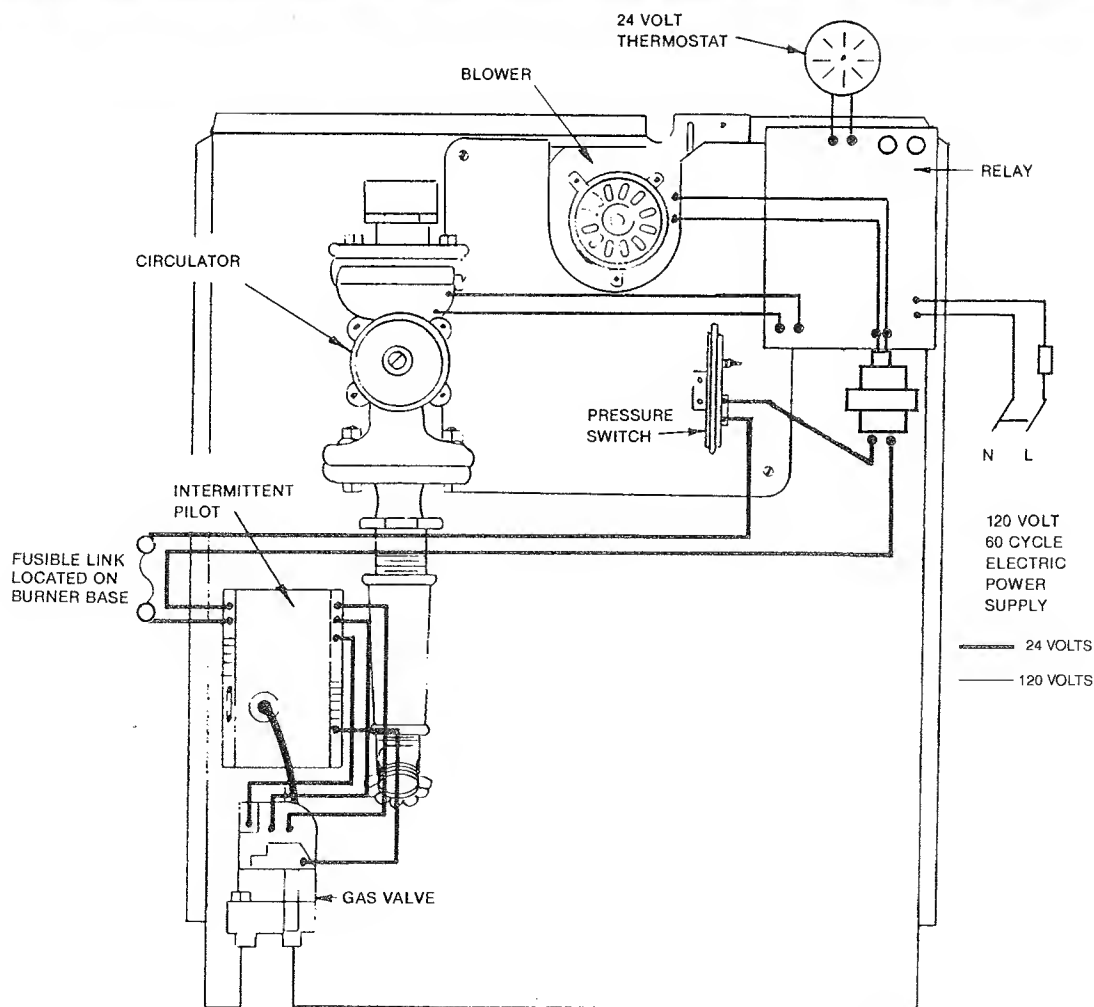
The boiler controls are all wired at the factory. You need only connect a 120 volt electric supply and the thermostat. Connect the thermostat to TV and T terminals located in the relay control, (see page 11).

CONNECTING 120 VOLT WIRING TO BOILER

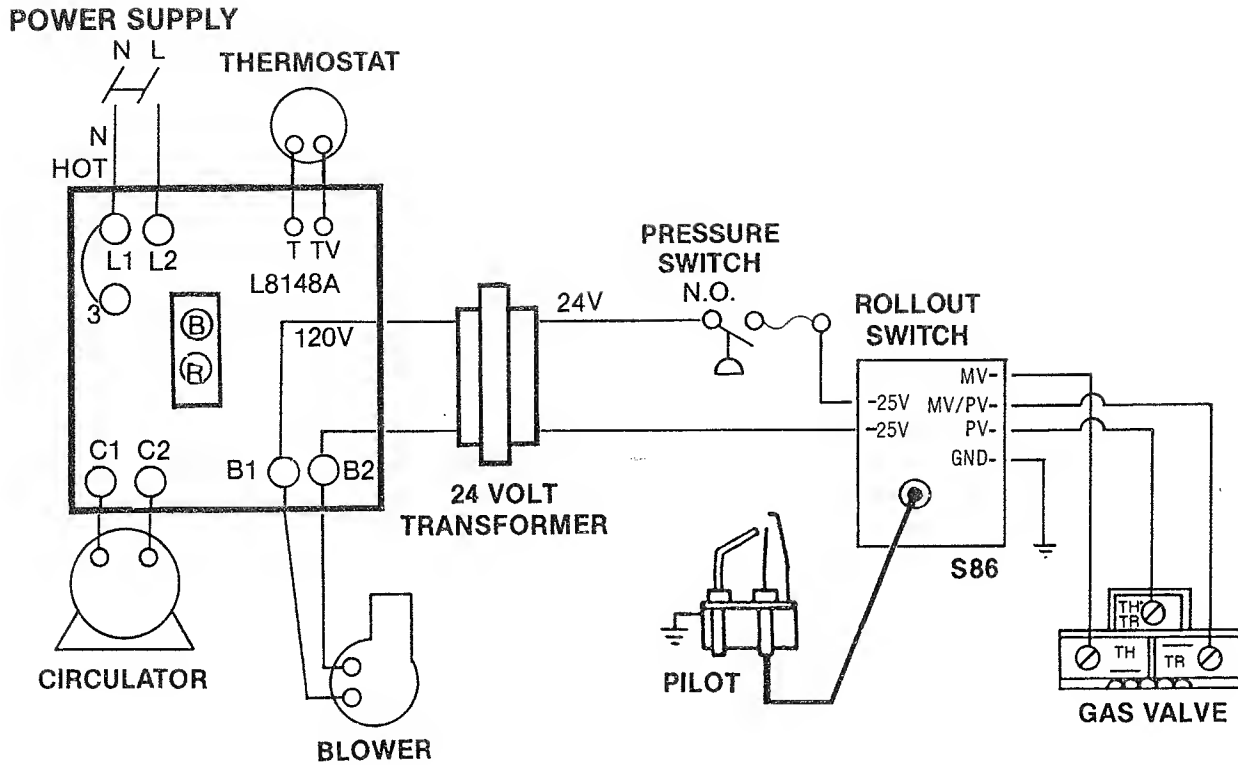
Run a separate circuit from a separate fuse in your electrical service entrance panel. This should be a 15 ampere circuit. Locate a shut-off switch at the boiler. It must be turned OFF during any maintenance.

Remove relay cover and connect the 120 volt electric supply wires to terminals L1 and L2 (Page 11).

FIG. 13 - CONNECTING WIRING



Electrical Wiring



IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED,
IT MUST BE REPLACED WITH THE SAME WIRE OR ITS EQUIVALENT.

Equipment and Optional Accessories - What They Do

RELIEF VALVE

You must have a relief valve on your boiler. Water expands as it is heated. If there is no place for the water to expand into, water pressure will build up inside the boiler and system. Should this happen, the Relief Valve will automatically open at a pre-determined pressure. This will relieve the strain on the boiler and system. Run a pipe from the relief valve outlet (pipe must be same size as outlet and the open end must not be threaded) to an open drain, tub or sink, or other suitable drainage point not subject to freezing. Failure to do so may cause water damage or injury should relief valve release.

EXPANSION TANK (Optional)

In a properly assembled system, the expanding water flows into an Expansion Tank. This tank should be of the correct size.

The tank is filled with air. As the water expands it compresses the air in the tank to form an air pressure cushion. This "spring-like" cushion serves to maintain correct operating water pressure regardless of water temperature. This assures a "full measure" of water, even in the highest radiation unit of the system. It also prevents blowing off of the relief valve.

The air in the tank in the beginning (with system filled with cold water) is sufficient for proper operation. The tank also serves as a trap for excess air in the system. The air would cause gurgling in the pipes and inefficient circulation in the radiators if left in the system.

It is possible for a tank to become "water-logged" (filled with water). It can also become overfilled with air. This can happen after filling the system with new water. Fittings provided on the tank and in the line to the tank are for bleeding off excess water or air.

When installing this tank, it is important: 1) That the tank be higher than the boiler top. 2) That the pipe to the tank continuously rises up to the tank (so that air can "bubble" up to it).

DIAPHRAGM TYPE EXPANSION TANK (Optional)

The Diaphragm Type Expansion Tank (EX-TROL) takes the place of the conventional expansion tank. Carefully read the instructions packed with your EX-TROL Tank Assembly.

The EX-TROL Tank comes to you with a 10-12 pounds per square inch air charge. This is the same as the pressure produced in the system by the automatic fill valve. When the system is first filled, the EX-TROL Tank will contain little or no water.

As the water is heated its pressure increases. It expands into the EX-TROL Tank, compressing the air in the tank. This compressed air cushion permits the water in the system to expand as the temperature changes.

The Diaphragm Type Tank can be mounted on the Air Purger fitting or at any other convenient place in the supply or return line.

AIR ELIMINATING FITTING (AIR PURGER) (Optional)

An Air Purger is used to remove excess air from the system. It is installed in the supply line. It will eliminate air from the water before it reaches the radiators and bleed off this air.

MAIN AIR VENT FOR DOWN FLOW SYSTEMS OR DIAPHRAGM TYPE EXPANSION TANK (Optional)

Before a system is filled with water, there is air in the pipes and radiation units. Some of it will be trapped as the system is filled.

It is possible to eliminate most of this air through the air vents on the radiation units. A Main Air vent will speed and simplify this. It should be installed on the highest point in the supply main when all radiation is below top of boiler.

AUTOMATIC FILL VALVE (Optional)

For safe, efficient operation, a hot water system must be filled with water. Adding new water, when needed can be done manually (by use of a hand valve in the water supply line). This requires regular attention to the system's needs. An Automatic Fill Valve accomplishes this without attention. It is installed in the Supply Line on hot water boilers only. The Valve operates through water pressure differentials. It does not require an electrical connection.

DRAIN VALVE

This manual valve provides a means of draining all water from the boiler and system. It is often installed in the $\frac{3}{4}$ " tapping at the bottom of the left boiler section. Or it can be installed in a tee where the return line enters the boiler.

WATER TEMPERATURE CONTROL

The water temperature limit control in the relay is adjustable and may be set as necessary. It may be set as low as 140° F, or as high as 240° F. This depends on the type and amount of radiation involved and weather conditions.

CIRCULATING PUMP

Every Forced Hot-Water System requires a Circulating Pump. A separate pump or zone valve is required for each Zone, if you have two or more Zone Systems. This pump must have the capacity to provide the circulation required by your system. The pump is connected into the Return Main just ahead of the boiler. It is also wired to the electrical system.

BLOWER (DRAFT INDUCER)

The blower provides a means for pulling air through the boiler and exhausting the flue gasses into the vent system. There is a damper built into the outlet of the blower which operates from the pressure generated by the blower. It closes when the blower is off. This keeps heat in the house rather than having it go up the chimney.

PRESSURE SWITCH

The air pressure switch works on a negative pressure. When the blower comes on the air pressure switch operates the intermittent pilot and gas valve. The air pressure switch is factory set and will only work when the blower operates properly. It will not allow the boiler to come on if the blower does not generate enough pressure or if the chimney or flue ways are blocked.

ROLLOUT SWITCH (FLAME ROLLOUT SAFETY SHUTOFF)

The rollout switch is a temperature-sensitive fuse link device. It is located on the boiler base just outside the fire box. In the event of heat exchanger flueway blockage causing flame to roll out of the fire box, the fuse will blow, shutting down the flow of gas to the main burners. The fuse does not change in appearance when blown.

If the rollout switch blows, it must be replaced with an exact replacement. Check heat exchanger flueways for blockage when restoring system to operating condition. Do not operate system without a rollout switch.

Starting Your Boiler

HOW A HOT-WATER SYSTEM OPERATES

Your entire heating system (boiler, piping and radiation units) is filled with water. As the water in the boiler is heated, it is pumped from the top of the boiler through the supply main to the radiation units. The cooler water in them flows back through the return main to the boiler. This provides positive and rapid response to the thermostat.

FILLING SYSTEM WITH WATER

Close the Air Vents on all radiation units. Open the Valves to these units. Make sure the boiler and Expansion Tank Drain Cocks are closed. The Air Bleed Screw on the tank Drain Fitting should be closed. Open the valve in the line from the boiler to the expansion tank (see page 13 for additional information). Open the water inlet to your boiler and leave it open. Start with the **lowest** radiation unit. Open the air vent on this unit. When all the air has escaped and water starts to flow from the vent, close it. Go to the next radiation unit, and repeat this process. Repeat until you have covered every radiation unit in the system (ending up at the highest unit in the system). If your units have automatic vents, this manual venting is unnecessary but it will speed up the proper filling of your system.

If your system is a closed expansion tank system, you may have an Automatic Fill Valve. You may leave it open to refill the system automatically as needed. Check the temperature-pressure gauge. Note the position of the hand indicating pressure. This should be between 10 and 15 lbs. Any lowering of this movable hand below 10 lbs. will indicate loss of water due to leakage. The automatic fill valve should compensate for this. Instructions are packaged with the valve.

WARNING - Never run water into a hot empty boiler.

FOR YOUR SAFETY READ THIS BEFORE OPERATING

1. This appliance is equipped with an ignition device which automatically lights the burner. Do **not** attempt to light the burner by hand.

WARNING: If you do not follow these instructions exactly, fire or explosion may result with property damage, personal injury, or loss of life.

2. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WARNING: IF YOU SMELL GAS:

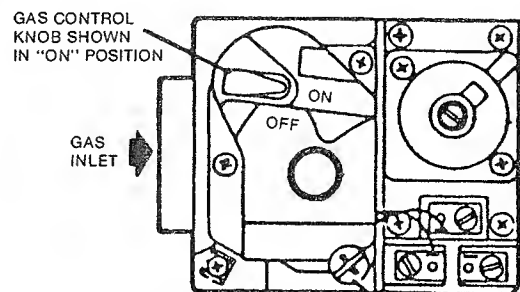
- Do not attempt to operate any appliance, do not touch any electrical switch, do not use the phone.
- Leave the building immediately and call your gas supplier.
- If your gas supplier cannot be reached, call the fire department.

3. **WARNING: When turning or depressing the gas control knob, use only your hand to push down or turn the knob. Never use tools. If the knob will not operate by hand, the control must be replaced by a qualified service technician. Force or attempted repair may result in a fire or explosion.**

4. **WARNING: If any part of this appliance has been under water, do not operate. Immediately call a qualified service technician to inspect the appliance and to replace any part of the gas control system which has been under water.**

OPERATING INSTRUCTIONS

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. Do **not** attempt to light the burner by hand.
4. Remove burner access panel.
5. Depress gas control knob slightly and turn clockwise ➡ to "OFF" position.



NOTE: Knob cannot be turned to "OFF" unless knob is depressed slightly. Do not force.

6. **WARNING: Wait five (5) minutes to allow any gas in the combustion chamber to vent. If you then smell gas in the appliance area or near the floor, do not touch any electrical switch, do not use the phone. Leave the building immediately and call your gas supplier. If your gas supplier cannot be reached, call the fire department. Failure to do so may result in a fire or explosion. If you don't smell gas, go to next step.**
7. Turn gas control knob counterclockwise ➡ to "ON."
8. Turn on all electric power to the appliance.
9. Set thermostat to desired setting.
10. After visually inspecting the flame, replace the lower front panel.
11. **WARNING: If the appliance will not operate after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.**

TO TURN OFF APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if servicing is to be performed.
3. Depress gas control knob slightly and turn clockwise ➡ to "OFF" position. Do not force.

Checking and Adjusting

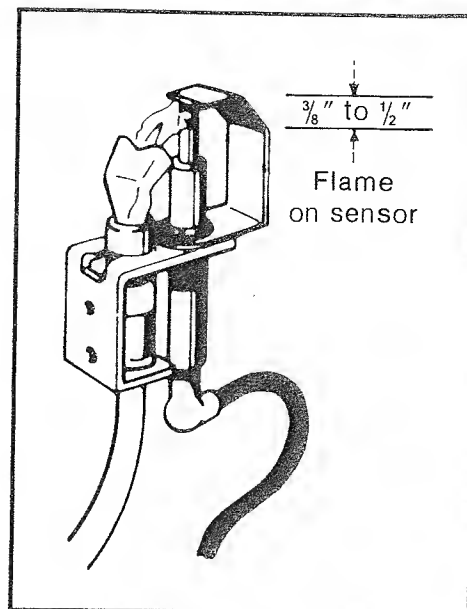
GAS VALVE SAFETY SHUTDOWN TEST

With main burners firing, disconnect the ignition cable from the intermittent pilot control box. The gas valve should shut off the main burners. TURN OFF ELECTRIC POWER to boiler before reconnecting ignition cable, to prevent electric shock.

ADJUST PILOT BURNER

1. Remove screw cover over pilot adjusting screw.
2. Insert small screwdriver and adjust flame as needed (Fig. 14). Turn screw counter-clockwise to increase flame, clockwise to decrease (Fig. 15).
3. Replace screw cover over pilot adjusting screw.

FIG. 14 - PILOT FLAME ADJUSTMENT



MAIN BURNER AIR ADJUSTMENT

The main burner is designed with a fixed primary air setting. It requires no adjustment.

ADJUST LIMIT CONTROLS

Instructions for each control are included with the controls.

RECOMMENDED BOILER WATER TEMPERATURES

Type of Heating Unit	Limit Control Setting
Standing Radiators	180° F.
Baseboard and Convector Radiators	200° F.

These settings can be changed after you have had some idea how the system works. Example: If your system does not give quite enough heat in very cold weather, you can raise the limit setting to 220° F. Use the boiler gauge to check your settings. Make the adjustments according to its readings.

ADJUST THERMOSTAT HEAT ANTICIPATOR

INSTRUCTIONS FOR THE FINAL ADJUSTMENT OF THE THERMOSTAT ARE PACKAGED WITH THE THERMOSTAT.

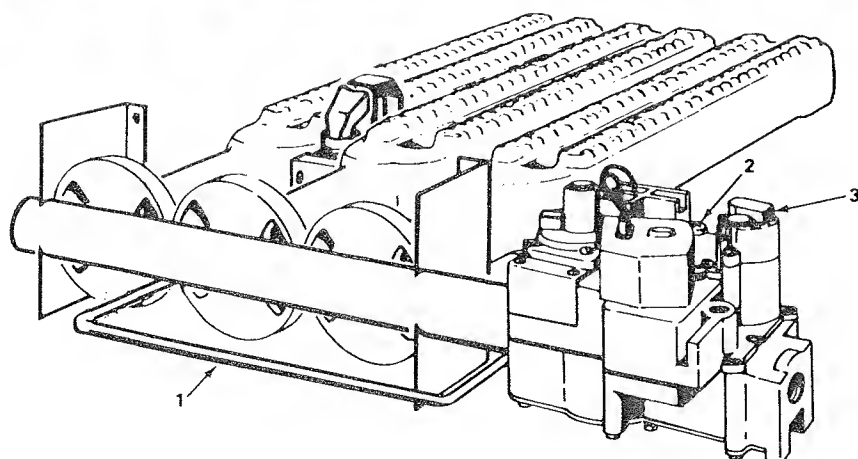
Set Heat Anticipator at .2.

Check thermostat operation. When set above temperature indicated on the thermometer, boiler burners should ignite. Make certain the thermostat turns off the boiler when room temperature reaches the selected setting and starts the boiler operating when room temperature falls a few degrees.

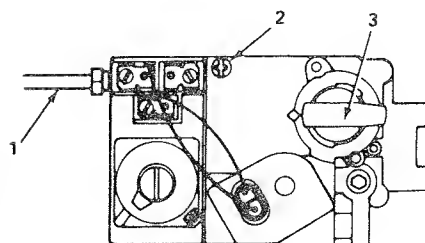
Finally, set the thermostat for the desired temperature. Special conditions in your home and the location of the thermostat will govern this setting.

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler when the boiler underwent tests specified in ANSI Z21.13-latest revision.

FIG. 15 - AUTOMATIC GAS VALVE



1. PILOT GAS TUBE
2. PILOT ADJUSTMENT SCREW COVER
3. CONTROL KNOB



After setting limit control to limit setting, check to see if it shuts off the gas supply to the burners. Turn your thermostat up to call for heat and let your boiler run until the temperature of the water reaches the limit setting. The gas valve should shut off and the circulator keep running until the thermostat is satisfied, or the water cools enough to restart the burners through the limit control.

To check the pressure switch, turn the boiler on and then by closing the damper with the damper arm indicator you should be able to shut off the main burners. When you release the damper the unit should start again.

Maintaining Your Boiler

BURNERS

A visual check of the pilot and main burner flames should be made at least once each year, preferably at the beginning of the heating season. See page 14 and Figures 14, 15 and 16.

RELIEF VALVE

This valve should open automatically when the system pressure exceeds the safe limit (30 pounds per square inch). Should it ever fail to open under this condition, shut down your system. Drain it until pressure is reduced below the safe limit. Then have the valve replaced immediately.

EXPANSION TANK

As previously noted, this tank may become waterlogged, or may receive an excess of air. Frequent automatic opening of the relief valve indicates water logging. A high boiler temperature accompanied by usually low radiation unit temperature (and "knocking") indicates excess air in tank.

To correct either condition, close the valve between the boiler and the tank. Drain the tank until it is empty. Check all the tank plugs and fittings. Tighten as necessary. Open the valve between the boiler and tank. Water will rise to the normal height in the tank if you have an automatic fill valve (otherwise, manually refill the system).

BOILER FLUE PASSAGES

Under normal operating conditions, with the burners properly adjusted, it should not be necessary to clean the boiler flue gas passages. However, to assure trouble-free operation, we recommend that you have the flue passages, burner adjustment, and operation of the controls checked **once each year** by a competent Service Technician.

Before the start of each season (or whenever system has been shut down for some time) recheck the whole system for leaks . . . and recheck the boiler and vent pipe for leaks. Replace or patch any boiler seals that are faulty.

VENT PIPE

The venting of this unit is very important and the piping should be checked at least once a season. If the vent piping shows any sign of leaking, replace it immediately.

WATER SYSTEM

If system is to remain out of service during freezing weather, always **drain it** completely (water left in to freeze will crack the pipes and/or boiler).

CLEANING YOUR BOILER AND BURNERS

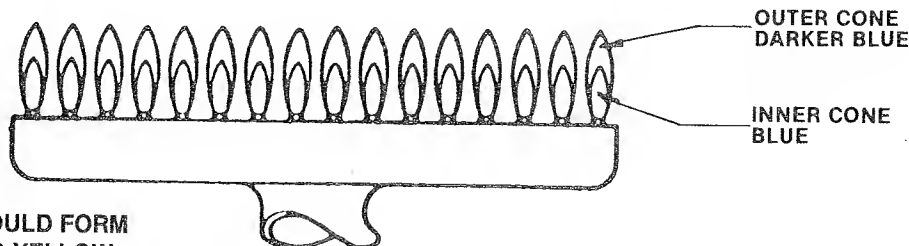
Flue passages between sections should be examined yearly and cleaned if necessary. To clean, remove burners, pilot and vent pipe. Remove top and front jacket panels. Split the silicone seal on the flue collector and the clean out plate with a razor knife. Remove flue collector. Remove clean out plate by tapping upwards on the bottom of the plate with a hammer. Remove loose silicone sealant from sections, flue collector, and clean out plate. Clean passageways between sections with a flexible handle wire brush and a straightened out wire coat hanger. Remove dirt from the bottom of the boiler and from between sections by vacuuming. Make sure all flame ports in burners are open and clear. Shake out or blow out all loose dirt in burners. Reassemble all parts. Seal flue collector and clean out plate to sections with silicone sealant (400° F RTV silicone sealant or equivalent). Reseal seams between adjacent sections where necessary. All joints **must** be airtight. Be sure to check tightness of pilot connections and condition of burner flames after reassembly (see Figure 16). Be sure vent pipe connections to chimney are secure and no obstructions are present.

BLOWER

The blower motor should be lubricated every six months with five drops of 20 weight non-detergent oil. There are two oiling points, over the front and rear bearings.

At the beginning of each heating season, ensure that the damper in the blower outlet opens and closes freely before firing boiler.

FIG. 16



THE MAIN BURNER FLAME SHOULD FORM
A SHARP BLUE CONE WITH NO YELLOW.

Service Hints

You may avoid inconvenience and service calls by checking these points before you call for service.

FOR YOUR SAFETY WHAT TO DO IF YOU SMELL GAS

1. Do Not try to light any appliance.
2. Do not touch any electric switch, do not use the phone.
3. Leave the building immediately, then call your gas supplier.
4. If you cannot reach the gas supplier, call the fire department.

IF YOUR SYSTEM IS NOT HEATING OR NOT GIVING ENOUGH HEAT . . .

Possible Cause	What to do
Thermostat is not set correctly	Reset thermostat above room temperature.
Burner is not operating properly	Check flame. If it is yellow, the burner is not getting enough air. Or, if flame is blue and noisy and seems to lift off the burner, the burner is getting too much air. Contact your service technician.
No electric power to boiler	Check fuse. If blown, replace. Check to be sure electric power supply circuit is "ON."
Controls out of adjustment	Reset according to instructions.
Radiators not heating	Open radiator vents to vent excess air. Check flow control valve (if used). It may be in closed position.
Circulating pump not running	Check fuse. If blown, replace. Check relay operation.
Poor electrical contact	Check all control terminals and wire joints.
Chimney flue is blocked	Pressure switch will not close and pilot spark will not operate to start pilot. Have your service technician check and correct, if necessary.

IF BURNER IS NOISY . . .

Possible Cause	What to do
Gas input amount is incorrect	Contact your service technician.

RELIEF VALVE LEAKING . . .

Possible Cause	What to do
Dirt on seat	Open valve manually. Allow water to run and clear valve seat.
Water logged expansion tank	Drain tank, see instructions.

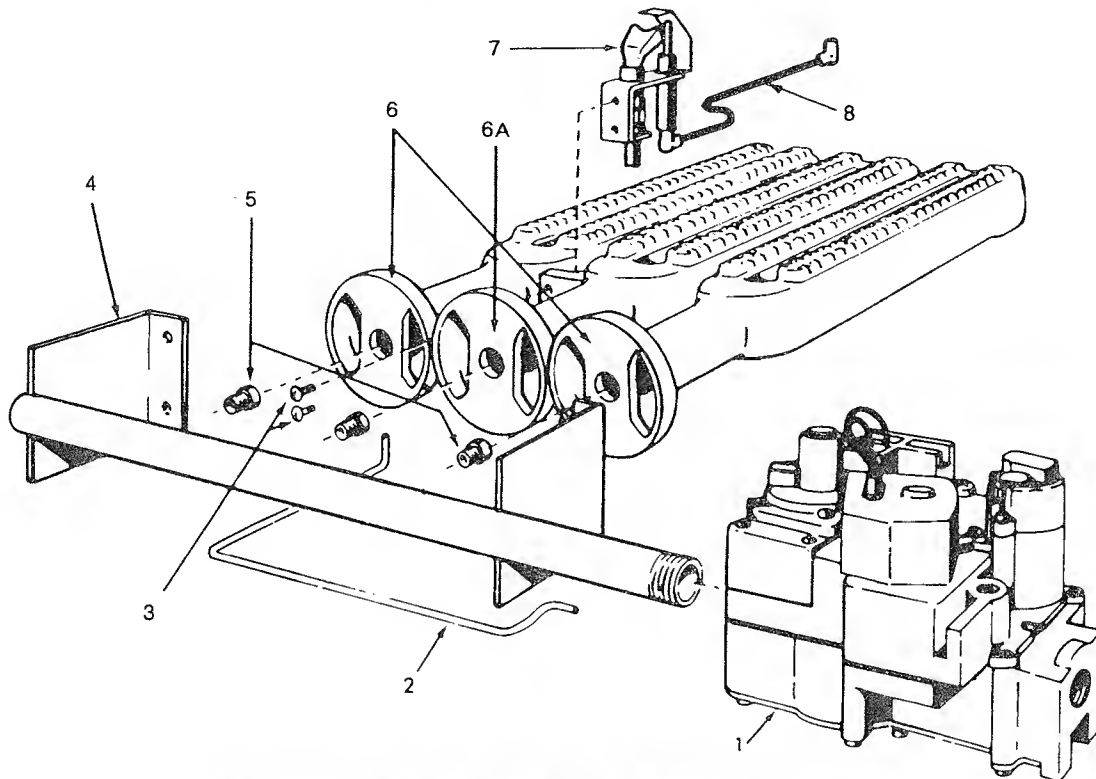
HAVE YOUR SERVICE TECHNICIAN CHECK ANY PROBLEM YOU ARE UNABLE TO CORRECT.

Repair Parts

IMPORTANT — READ THESE INSTRUCTIONS BEFORE ORDERING

All parts listed in the following Parts List may be ordered through your nearest supplier or direct from the factory. When ordering parts, first obtain the Model Number from the data plate on your boiler, then determine the Part No. (not the Key No.) and the Description of each part from the following illustrations and list. Be sure to give us all this information: The Part No. - The Part Description - The Boiler Model No.

FOR USE WITH NATURAL GAS ONLY



NATURAL GAS BURNERS & MANIFOLD PARTS THIS IS A REPAIR PARTS LIST - NOT A PACKING LIST

KEY NO.	DESCRIPTION	PART NUMBERS FOR			
		2 Section	3 Section	4 Section	5 Section
1	24 Volt Gas Valve, Natural Gas	146-62-052	146-62-052	146-62-052	146-62-052
2	Pilot Tube	146-15-005	146-15-005	146-15-005	146-15-005
3	10-32 x 1/2" Slotted Hex Head Screws (2 Required)	146-95-307	146-95-307	146-95-307	146-95-307
4	Gas Manifold	146-16-042	146-16-043	146-16-044	146-16-045
5	Orifice - Natural Gas*	146-15-030	146-15-031	146-15-031	146-15-031
6	Gas Burner**	—	146-15-526	146-15-526	146-15-526
6A	Gas Burner with Pilot Bracket	146-15-522	146-15-525	146-15-525	146-15-525
7	Pilot Burner with Orifice, Natural Gas	146-62-054	146-62-054	146-62-054	146-62-054
8	Ignition Cable	146-62-074	146-62-074	146-62-074	146-62-074
‡	Owners Manual				

‡ Not illustrated.

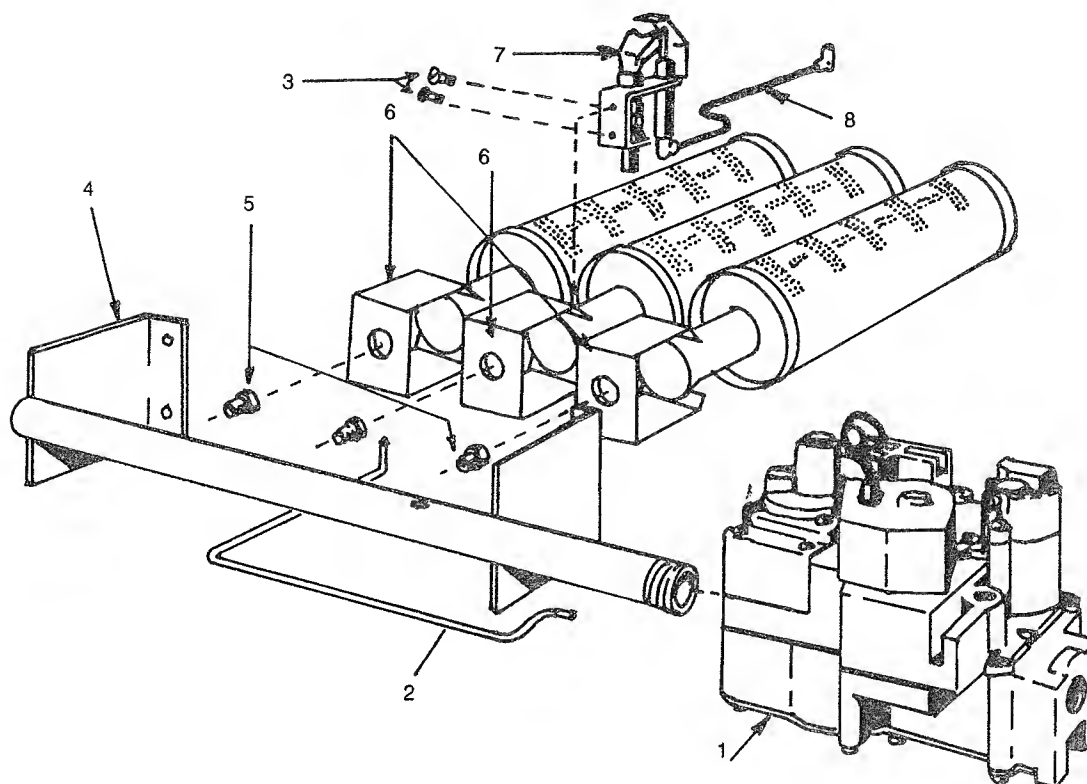
Quantity is 1 unless otherwise noted.

*Requires 1 less than the number of sections.

**Requires 2 less than the number of sections.

Repair Parts

FOR USE WITH LIQUEFIED PETROLEUM GAS ONLY



LIQUEFIED PETROLEUM GAS BURNERS & MANIFOLD PARTS THIS IS A REPAIR PARTS LIST - NOT A PACKING LIST

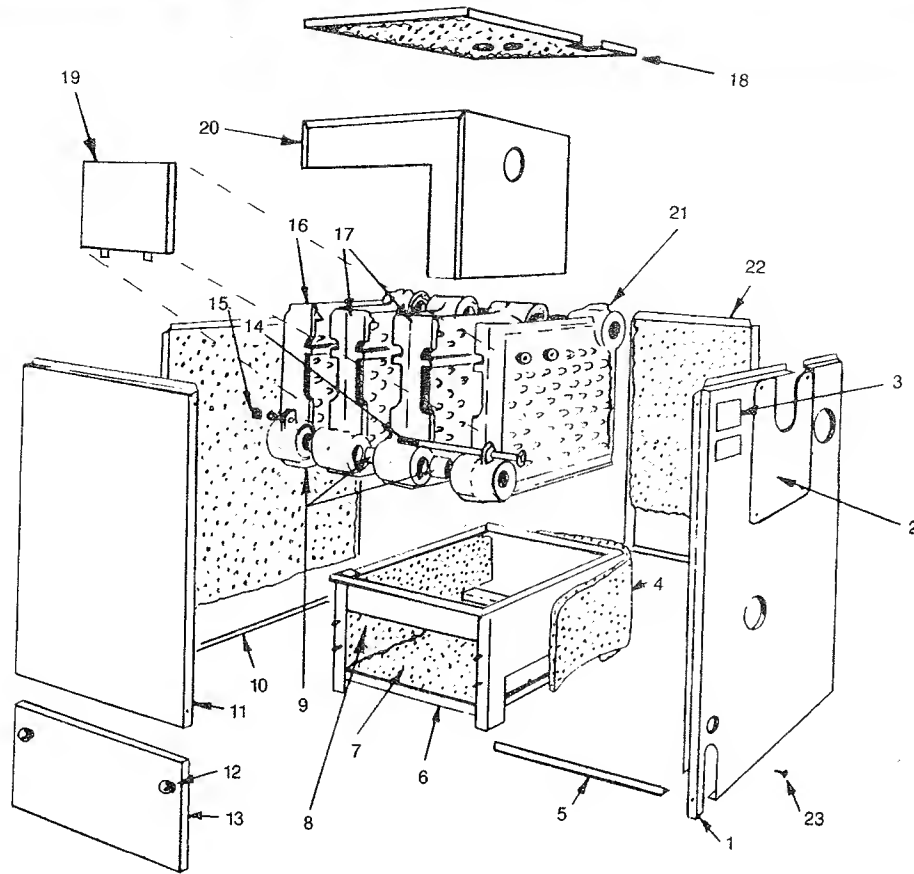
KEY NO.	DESCRIPTION	PART NUMBERS FOR			
		2 Section	3 Section	4 Section	5 Section
1	24 Volt Gas Valve, Liquefied Petroleum Gas	146-62-047	146-62-047	146-62-047	146-62-047
2	Pilot Tube	146-15-005	146-15-005	146-15-005	146-15-005
3	10-32 x 3/16" Slotted Hex Head Screw (2 Required)	146-95-301	146-95-301	146-95-301	146-95-301
4	Gas Manifold	146-16-020	146-16-021	146-16-022	146-16-023
5	Orifice - Liquefied Petroleum Gas*	146-15-036	146-15-036	146-15-036	146-15-036
6	Gas Burner*	146-15-529	146-15-529	146-15-529	146-15-529
‡	Pilot Bracket	425-00-885	425-00-885	425-00-885	425-00-885
7	Pilot Burner with Orifice, Liquefied Petroleum Gas	146-62-038	146-62-056	146-62-056	146-62-056
8	Ignition Cable	146-62-074	146-62-074	146-62-075	146-62-075
‡	Rollout Shield	425-01-932	425-01-933	425-01-934	425-01-935
‡	Owners Manual				

‡ Not illustrated.

Quantity is 1 unless otherwise noted.

*Requires 1 less than the number of sections.

Repair Parts

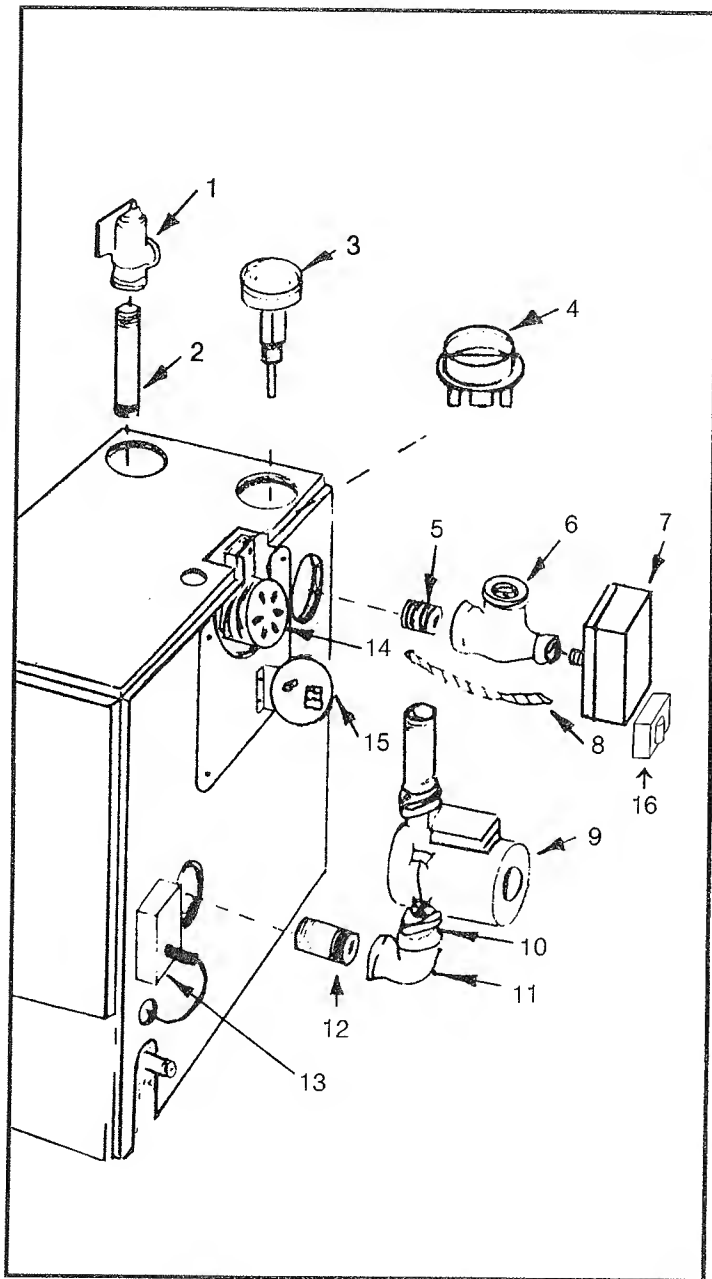


KEY NO.	DESCRIPTION	PART NUMBERS FOR			
		2 Section	3 Section	4 Section	5 Section
1	Jacket Right Side Panel	425-01-492	425-01-492	425-01-492	425-01-492
2	Blower Cover Plate	425-01-538	425-01-538	425-01-538	425-01-538
3	Rating Plate	146-94-016	146-94-016	146-94-016	146-94-016
4	Insulation, Base Sides	433-01-826	433-01-827	433-01-828	433-01-829
5	Jacket Tie Bar	425-01-494	425-01-495	425-01-496	425-01-497
6	Boiler Base	425-01-733	425-01-734	425-01-735	425-01-736
7	Insulation, Base Pan	433-01-825	433-01-834	433-01-835	433-01-836
8	Insulation, Inside, Base Side (2 Required)	146-14-020	146-14-020	146-14-020	146-14-020
9	Nipple, Boiler	433-01-976	433-01-976	433-01-976	433-01-976
10	Jacket Left Side Panel	425-01-493	425-01-493	425-01-493	425-01-493
11	Jacket, Front Panel	425-01-502	425-01-503	425-01-504	425-01-505
12	Knobs, Jacket Door	137-02-153	137-02-153	137-02-153	137-02-153
13	Jacket Access Door	425-01-510	425-01-511	425-01-512	425-01-513
14	1/4" Tie Rod (2 Required)	146-05-008	146-05-002	146-05-002	146-05-051
15	Nut & Washer	146-95-041	146-95-041	146-95-041	146-95-041
16	Section, Left End	410-01-019	410-01-019	410-01-019	410-01-019
17	Section, Intermediate	—	410-01-018	410-01-018	410-01-018
18	Jacket Top Panel	425-01-526	425-01-527	425-01-528	425-01-529
19	Cleanout Plate	425-01-539	425-01-540	425-01-541	425-01-542
20	Flue Collector	425-01-534	425-01-535	425-01-536	425-01-537
21	Section, Right End	410-01-017	410-01-017	410-01-017	410-01-017
22	Jacket Back Panel	425-01-518	425-01-519	425-01-520	425-01-521
‡	Jacket, Complete	425-01-741	425-01-742	425-01-743	425-01-744
23	10 x 1/2" Sheet Metal Screw	146-95-074	146-95-074	146-95-074	146-95-074
‡	1/4-20 x 1" ST Screw	146-95-054	146-95-054	146-94-054	146-95-054
‡	5/16" x 1 1/4" Hex Slotted Washer Head ST Screw	146-95-039	146-95-039	146-95-039	146-95-039
‡	Rollout Switch Bracket (Nat. Gas Only)	425-00-604	425-00-604	425-00-604	425-00-604

‡ Not illustrated.

Repair Parts

BOILER CONTROLS AND PIPING



KEY NO.	PART NO.	DESCRIPTION
1	146-22-011	3/4" ASME Relief Valve
2	146-07-040	3/4" x 5" Nipple
3	146-23-003	Temperature Pressure Gauge
4	146-29-004	Adapter
5	146-07-019	1 1/4" x 5 1/2" Nipple
6	146-93-049	1 1/4" x 3/4" x 1 1/4" Tee
7	146-62-016	Comb Hi Limit & Relay Control L8148A
8	433-00-912	BX Circulator Cable
9	146-26-047	Circulator
10	146-07-009	1 1/4" Close Nipple
11	146-93-042	1 1/4" Ell
12	146-07-017	1 1/4" x 6" Nipple
13	146-62-303	Intermittent Pilot Control (Nat. Gas)
13	146-62-071	Intermittent Pilot Control (Propane Gas)
14	433-00-510	Induced Blower
15	146-55-002	Pressure Switch
16	146-62-080	24-Volt Transformer
‡	433-00-911	BX Blower Cable
‡	146-29-003	Plastic Tube (Blower to Pressure Switch)
‡	146-29-002	Rollout Switch

‡ Not Illustrated